Managing Water Resources Past and Present

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The Development of American Water Resources: Planners, Politicians, and Constitutional Interpretation

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To understand the development of American water resources, one must first look at American political and social values and American governmental institutions. Even a cursory examination shows the lasting influence of decisions and attitudes moulded as the country took its first hesitant steps as a republic. Historian Joyce Appleby (2000: 249) has argued that the first generation of Americans bequeathed 'open opportunity, an unfettered spirit of inquiry, [and] personal liberty' to future generations—qualities, we might note, that often introduce an element of uncertainty into public administration. But if we extend the analysis a bit, we might not only gain an appreciation of the many challenges facing water resource developers, but also illuminate a fundamental question facing democratic nations: to what extent should human liberty be constrained in order to provide and manage a human necessity—water.

Beyond Appleby's observations, one notes at least two pervasive elements woven into American political behaviour. The first, the inescapable, element is distrust of powerful governments. Power corrupts, the first Americans agreed without much hesitation, and the challenge was how to minimize that corruption, how to ensure that good men will not be enticed to do evil, and how to disperse power to minimize oppression. Loudly over the years, Americans continue to proclaim their distrust of big government; even popular presidents generate scepticism when they appear to reach for increased power and authority. Only as a last resort, and then with resignation, not enthusiasm, as during the Great Depression, do Americans turn to the national government to solve their problems (Kelley 1989: 30–1; Wills 1999). The result can be truly impressive: Grand Coulee and Bonneville dams, locks and dams on the Upper Mississippi, the California Central Valley

Project, and the Los Angeles flood control system all came out of depression-era politics, but, as I will argue, all are aberrations in the story of American water resources.

The second element, almost as pervasive as the first, is that power and liberty are fundamental antagonists. The dispersion of power among the three branches of government purposely sets power at war with itself rather than with 'life, liberty, and the pursuit of happiness'. Each branch would be allowed only sufficient power to discharge official duties, and a system of checks and balances would guard against abuse (Wood 1969: 150–61). Recoiling from British monarchism, the constitutional drafters took special care to try to prevent executive branch intrusions into the duties of the other two branches. This was a system that, regardless of its merits, made implementation of rational planning enormously difficult, as water developers soon appreciated.

Political attitudes were one thing; government structure was another. And here the Founding Fathers developed a system that guaranteed further complications. They fashioned a republican form of governments within the government. A century later, young political scientist Woodrow Wilson (1887: 221) thought that this structure posed the principal challenge to American administration. Few water resource planners would disagree. Republican government, it must be remembered, began in the states, not in the new national capital; delegates to the Continental Congress delayed business so they could go home and participate in state constitutional conventions. The formation of these state governments may have excited Americans more than the latter formation of the union itself (Wood 1969: 128), and the American Constitution explicitly guaranteed to each state a republican form of government (Article IV, Section 4). Once the United States achieved its independence, many Americans pondered how citizens could owe allegiance to two governments, two legislatures, simultaneously. Were the states and national government partners or were the states meekly to accept national supremacy? No one at the Constitutional Convention quite knew what to expect from this layer-cake of powers (or was it a marble-cake, twentieth-century political scientists later debated), and numerous, contrary explanations emerged of what the delegates had actually achieved (Elazer 1969; Scheiber 1966). In no area did the confusion become more manifest or disruptive than in internal improvements, especially in water projects that crossed state lines.

The term 'internal improvements' came to mean many things to the citizens of the young republic. It included roads, canals, schools, lighthouses, fortifications, and even technological innovations—almost anything that seemed to provide security and promote the economy. Gradually it came to mean something a bit more specific, though still covering (forgive the pun) a large amount of ground: it applied to what we now call 'infrastructure', and

water transportation was a central concern. Benjamin Franklin had proposed at the Constitutional Convention that Congress have the power to construct canals, but opponents won the day, fearing that Congress would become too powerful (Albjerg 1932: 168–9). In fact, the term 'internal improvements' cannot be found in the American Constitution, an obstacle for those seeking affirmative authority for federal involvement in public works. But neither did the Constitution proscribe the activity, which meant to internal improvement advocates that the function lay legitimately within federal authority. This ambiguity not only produced a constitutional quagmire for internal improvements, but it provided a platform upon which larger issues of the role of government and the nature of liberty could be debated. In short, the internal improvements issue amplified and sharpened the debates about the very nature of American republicanism. By any other name, it continues to serve that function to the present day.

Given Americans' distrust of government and emphasis on personal liberty, America's first politicians, and all the generations following, confronted the difficulty of promoting economic growth without expanding governmental authority. One answer was the corporation, a device that actually predated the Constitution but in the age of internal improvements became much favoured. As presumed promoters of the public good, they effectively became agencies of government (Maier 1993: 55). In this way, legislatures could support economic and political development without necessarily involving tax revenue. The fact that individual incorporators might thereby profit aroused little concern. The more important point was that corporations brought together sufficient capital to launch an enterprise, whether a canal or a municipal water system. Even if a number of these ventures brought forth charges of corruption, internal improvement advocates ceaselessly trumpeted the moral and intellectual gifts stemming from public works, as though canals were spiritual as well as economic enterprises. To complaints that corporations disenfranchised people and led to the inequitable distribution of wealth, champions argued—somewhat quaintly in light of what subsequently emerged—that corporations were nothing more than little republics that were eminently suited for the United States (ibid. 58–69). For better or worse, the victory of the corporation in American life was almost as revolutionary as the victory of republicanism itself, and the alliance between government and corporations became a hallmark of American economic development. Government was not to replace business, but was to support and, within certain limits, protect it.

George Washington and other Federalists had ardently hoped that corporations might provide the capital and means to build internal improvements to bind the nation together and transcend local interests, perhaps leaving overall planning to the national government. But the chance slipped through their hands. The structure of Congress assured that state interests in

internal improvements would prevail over national interest. There would be no national board, no national planning. Rather, Congress would periodically pass Rivers and Harbors Acts that generally reflected parochial politics. To stimulate states and the private sector, Congress also provided a percentage of funds obtained from the sale of public lands in new states to finance roads and canals (the three and five per cent funds dating back to 1802) and voted to turn over certain lands to states for reclamation (Swampland Acts of 1849 and 1850) (Goodrich 1960; Harrison 1961: 67–88; Hibbard 1965: 228–898; Larson 2001: 5–7). In a few cases, too, Congress might vote to subscribe to canal stock or even grant land to a company—a practice that presaged the enormous land grants given to railroad companies as they extended their lines across the continent later in the century.

In many cases, river and harbour bills met overwhelming resistance from the executive branch, mainly because of concerns over constitutionality, yet one more issue that reverberates through much of America's history. The specific points usually centred on presumed lack of constitutional authority to construct works of mainly local and even private benefit or works on rivers that were not clearly navigable. Pre-Civil War Presidents either practised an inconsistent policy towards public works or became adamant opponents. Thomas Jefferson objected to federal involvement because it would empower the government at the expense of the common man, burden the taxpayer, lead to projects benefiting one location at the cost of another, and enrich men at public expense. James Madison, who had been an early internal improvements advocate, on the evening before his departure from the White House vetoed the Bonus Bill that would have provided funds for public works, declaring that the Constitution did not empower Congress to appropriate money for public works without an 'inadmissible latitude of construction' (quoted in Larson 2001: 68; see also Albjerg 1932: 170). James Monroe at first thought that Congress could appropriate funds for public works but agreed with Madison that the federal government had no authority to construct the projects. Later, he determined that Congress might construct public works after all but only for those projects that were 'national not state, general not local,' a clarification that left the proverbial barn door open for defining local and general (Albjerg 1932: 171; Larson 2001: 183).

Andrew Jackson saw himself as a friend of internal improvements, but he feared the extension of federal power, sought a clarifying constitutional amendment on the appropriate national role in internal improvements, and admitted, like Monroe, that, while the federal government could appropriate money for truly national projects, it could not actually construct the projects itself. Strict constitutional constructionist James K. Polk vetoed every rivers and harbours bill sent to him. He even went to his office on the last day of his administration with a veto message in hand should Congress

try to pass an internal improvements bill at the last moment. Abraham Lincoln, a young Whig congressman from Illinois, succinctly captured the problem in his denunciation of Polk's veto of the 1848 Rivers and Harbours Act. 'The just conclusion from all this is that, if the nation refuses to make improvements of the more general kind because their benefits might be somewhat local, a state may, for the same reason, refuse to make an improvement of a local kind because its benefits may be somewhat general. A state may well say to the nation, "If you will do nothing for me I will do nothing for you"' (quoted in Kemper 1949: 112). In the following decade, Franklin Pierce vetoed five rivers and harbours bills on the grounds of unconstitutionality. As Civil War erupted in the land, the political and philosophical jousting over water projects remained as short of resolution as ever (Kelley 1989: 31; Larson 2001: 183; Albjerg 1932: 171, 176).

Given the fears, hopes, and questions facing the early American republic, it is little wonder that it saw no successful implementation of co-ordinated public works administration. Perhaps more surprising is that this became a permanent condition in the United States. Funding issues, sectional friction, and constitutional questions invariably posed insurmountable barriers. Prior to the Civil War, the federal government attempted twice to develop and implement a national programme of public works. The first was the well-known Gallatin Plan. At the request of Congress, Secretary of Treasury Albert Gallatin proposed in 1808 an ambitious network of roads and canals connecting the Eastern seaboard with the interior and a coastal water route to shorten distances between major Atlantic seaboard cities. Gallatin argued that the federal government should construct internal improvements that provide 'annual additional income to the nation' but are beyond the capacity of private entrepreneurs to build (Gallatin 1808: 5). His formulation harkens back to Adam Smith's *The Wealth of Nations* and anticipates the term 'National Economic Development' that appeared in twentieth-century economic jargon. However, his effort fell victim to lack of funds (both private and public), New England opposition to the Jefferson Administration, and, finally, growing preoccupation with real and apparent British threats to the United States, which eventually resulted in war. It is also of more than passing interest that Gallatin himself agreed with President Jefferson that his plan could never be efficiently realized without a constitutional amendment (Pross 1938: 10).

The next great attempt occurred in 1824. President's Monroe's vacillation, the growing clout of new states interested in waterborne commerce, and a favourable Supreme Court ruling (*Gibbons* v. *Ogden*) that sanctioned federal control over interstate commerce, including rivers, based on the Commerce Clause of the Constitution, allowed passage of the General Survey Act at the end of April 1824, after weeks of acrimonious debate. The act carried largely because of support from the Middle Atlantic states (except

Delaware) and the new states west of the Appalachians. It authorized the President to use the army engineers to survey (not build) roads and canals (not rivers) that may be deemed 'of national importance in a commercial or military point of view, or necessary to the transportation of the public mail'.

Once the bill passed, Secretary of War John C. Calhoun organized a Board of Engineers for Internal Improvements to determine which routes should be surveyed among the scores suggested. Like Gallatin's plan, this programme could have become the beginning of a great nationwide, co-ordinated system of internal improvements. Instead, once projects were surveyed, they became subject to the same parochialism in Congress that had doomed earlier, similar ideas, and Congressmen continued to introduce pet projects for funding despite a contrary recommendation from the army engineers or the absence of a survey altogether. Its planning role severely diminished, the Board of Engineers languished, and a reorganization of the Corps of Engineers in 1830 provided an excuse for its abolishment. Six years later, Congress repealed the General Survey Act, partially a response to the legislature's own abuse of the act, using army engineers to survey potential projects of clear local and even private interest (Shallat 1994: 127–40; Larson 2001: 141–8; Hill 1957: 170–80). Thus began a contest between rational administration and congressional politics that remains unresolved and contentious into the twenty-first century.

Instead of national planning, Congress settled on a piecemeal approach to public works development. About three weeks after passage of the General Survey Act, President Monroe signed legislation appropriating $75,000 to improve navigation on the Ohio and Mississippi rivers—major routes to the western part of the country. The act empowered him to employ 'any of the engineers in the public service which he may deem proper' and to purchase the 'requisite water craft, machinery, implements, and force' to eliminate various obstructions. The two acts together initiated the permanent involvement of the Army Corps of Engineers in rivers and harbours work. However, each act focused on one activity: the General Survey Act on planning; the Ohio-Mississippi legislation on construction. Two years later, Congress combined surveys and projects in one act, thus establishing a pattern that lasts until the present. The 1826 act, therefore, can be called the first true rivers and harbours legislation.

By the time of the Civil War, the federal contribution to river, harbour, and canal improvements amounted to about $17 million in appropriated monies. Some 4.6m. acres of public lands were given for canal improvements and another 1.7m. acres for river improvements. Land grants under the 1849 and 1850 Swampland Acts and the 1841 Land Grant Act totalled some 73 million acres. While these grants and appropriations were significant, they represented a modest amount of aid compared with state and

private sector contributions, which by 1860 totalled well over $185m. for canals alone (Reuss 1991: 5). Corporations and public agencies spent many millions more on the construction of urban water systems.

Many of the canal companies incorporated by the states ran into trouble. The 1837 depression had driven a number into bankruptcy; others survived, but only with a healthy influx of state money, state-guaranteed bonds, and occasional federal and state land grants. Often, too, the national story was repeated at the state level, with rationally planned canal routes sacrificed to local political pressures to extend canals to uneconomical out-of-the-way villages. The one major exception to this sad story was the Erie Canal, whose success had spurred the canal boom that increasingly appeared more like a dismal bust, especially with new competition from the railroads. From Pennsylvania to Ohio to Indiana to Illinois and on into the states of the old Northwest, canal fever turned to canal panic, and the public lost faith in both the companies and the politicians who had supported the enterprises (Larson 2001; Goodrich 1960).

The American Civil War (1861–5) also affected the development of water projects. Military action and wartime budgetary constraints took their toll on many of the nation's ports and navigable waterways, and after the war commercial development accelerated demands for waterway improvements. A business-oriented Republican Congress responded by authorizing a great deal more money for rivers and harbours. The federal government also took over many of the bankrupt canal companies, and the Corps of Engineers became the custodian of former private or state waterways. This, as one author put it, was the 'Golden Age of the Pork Barrel' (Pross 1938). Between 1866 and 1882, the presidents signed sixteen Rivers and Harbors Acts. The 1866 Act appropriated $3.7m. for forty-nine projects and has been described as the first omnibus legislation, so called because, like a horse-drawn omnibus of the time, it provided room for a great many people boosting various projects. Sixteen years later, though, the 1882 Act appropriated five times more money. By that year, the federal government had spent over $111m. on rivers and harbours projects (ibid. 44, 52–3; Johnson 2000). 'Willingness to pay'—the primary test of project implementation before the Civil War—now included unprecedented federal largesse. In the so-called 'Gilded Age', lack of federal or non-federal funds was about the only thing that prevented construction.

By the 1880s the basic working relationship between Congress and the Army Corps of Engineers was set. Congress directed the Corps to survey potential projects, make recommendations, and provide cost estimates. Rivers and harbours acts funded both the surveys and the projects that Congress chose to authorize. Also in the early 1880s Congress mandated that the Corps of Engineers use more contractors and less hired labour. By the end of the century, contractors did nine-tenths of all waterways con-

struction, and no Corps officer could use hired labour without the express authority of the Chief of Engineers (Johnson 2000). Increasingly, then, the Corps became a funding conduit to the private sector. This pattern did not stop private sector engineers from calling for the complete elimination of the Corps from public works, but Congress rejected all bills that leaned in that direction.

Fear of railroad competition and questions about federal aid to projects of apparently local benefit moved the Senate in 1872 to create a Select Committee on Transportation Routes to the Seaboard. Composed of nine senators, the committee was headed by Senator William Windom of Minnesota and known popularly as the Windom Committee. Its 1873 report promoted waterway over railway transportation wherever waterways were properly located. Of more relevance here is the committee's conclusion (on a 5 to 4 vote) that the sum of local rivers and harbours projects contributed to the national interest (US Senate 1874). Generally accepted by Congress, this conclusion justified federal contributions for waterway improvements. The result was the authorization of dozens of dubious projects. By 1907, the cumulative total for rivers and harbours appropriations was more than four times the 1882 figure (and, of course, even greater if inflation is taken into account); the federal role in navigation improvements continued to grow.

Meanwhile, the issue of constitutional authority had somewhat changed focus. In 1870, the Supreme Court ruled in *The Daniel Ball* case that the common-law doctrine that navigability depended on tidal influence, a doctrine accepted in British courts, did not fit the American situation. However, the definition the Court substituted was extraordinary. The test of navigation was to be the river's 'navigable capacity'. That meant, the Court went on:

> Those waters must be regarded as public navigable rivers in law which are navigable in fact. And they are navigable in fact when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce over which trade and travel are or may be conducted in the customary modes of trade and travel on water. (Quoted in Hoyt and Langbein 1955: 166)

In short, American rivers were navigable if they were, are, or could be navigable. This decision, in combination with the earlier 1824 Court ruling, made the federal government the clear guardian and ultimate decision-maker on tens of thousands of miles of waterways in the United States. In practice it sufficed to show that a stream had the capacity to float logs to declare it navigable (Smith 1909: 33). However, with this issue more or less settled, another appeared: flood control.

Rivers always flood, but the floods do not always damage life and property. In the United States, we can trace floods as far back as 1543, when

Mississippi River floods stopped Hernando De Soto's expedition (Hoyt and Langbein 1955: 335). Naturally, as settlers moved into the floodplains and built villages, then cities, the damages increased. By the mid-nineteenth century, the problem was becoming critical along the lower Mississippi. Most people put their faith in technology to protect them. Indeed, the then popular term 'flood prevention' testifies to an extraordinarily unrealistic idea when one thinks about it. In the twentieth century, the term became 'flood control', a somewhat more modest formulation. Nowadays we speak of 'flood damage reduction', which probably comes closest to the mark. In any case, in the 1870s calls came for repairing and raising the levees on the Mississippi River. In 1879, Congress created a joint military–civilian Mississippi River Commission to develop and implement plans to improve navigation and flood control on the lower Mississippi. However, once again some Congressmen raised constitutional objections, expressing doubts that flood control was an appropriate federal activity. Until 1890 no appropriation could be used for repairing or constructing any levee in order to prevent damage to lands from overflow, or for any purpose other than deepening and improving the navigation channel (ibid. 172). The 1890 floods along the lower Mississippi resulted in the removal of this restriction, which, in any event, had had little practical effect other than satisfying congressional scruples.

Floods in 1912, 1913, and 1916 along the Ohio and Mississippi rivers eventually led to passage of the 1917 Flood Control Act, the nation's first act dedicated solely to flood control. It provided funds on a cost-shared basis for levee construction along the lower Mississippi and another appropriation to improve the Sacramento River in California. While an important step towards federal involvement in flood control, it was comparatively modest compared to what followed in the coming decades.

Congressional involvement in flood control happened incrementally and timorously. In comparison, its involvement in reclamation projects came quickly. Although Congress had appropriated money for various Western surveys and studies dating back to the early nineteenth century and had also passed several pieces of legislation making land 'dirt cheap'—no other expression suffices—for those willing to cultivate it, it had not seriously considered government assistance to develop Western water potential until the beginning of the twentieth century. As with flood control, some Congressmen raised constitutional objections, questioning the federal authority for condemning water in one state for use in another. The 1902 Reclamation Act created a revolving fund in which all the proceeds from public land sales were placed in the hands of the Secretary of the Interior to be used to construct irrigation works in the West. By law, more than half the revenue from land sales in a state was to be expended within that same state (Pisani 1992: 273–325). Eventually, the fund provided for hundreds of federal irrigation

projects that today dot the Western landscape, including such engineering marvels as Hoover and Glen Canyon dams on the Colorado River, the Central Valley Project in California, Pathfinder Dam in Wyoming, and Arrowrock Dam in Idaho. Nor can we forget the canals, pumps, and irrigation channels supported by the revolving fund. They may be less dramatic than the huge dams confined between looming canyon walls, but they are just as essential for irrigation. In theory, annual payments from project users would replenish the fund.

Initially, the reclamation fund totalled $6 million. The time limit for project repayment was set at ten years, then extended to twenty years in 1914, and to forty years in 1926. No interest charges were assessed. The law specified that water would not be provided to any tract of more than 160 acres, and it authorized the Secretary of the Interior to withdraw from the public domain any land necessary for project development (Dickerman Radosevich, and Nobe 1970). Homesteaders filed free claims to the land and received title to it after five years of residence. They quickly found ways to circumvent the 160-acre limitation, using partners and family members to gain control of a much larger tract. In fact, the law fostered a speculative frenzy. Many simply grabbed the free land and, once water was available, sold plots at inflated prices to true homesteaders, thereby forcing latecomers to start heavily in debt. The act also established a Reclamation Service within the US Geological Survey. In 1907 the Service became a separate agency within the Department of the Interior, and in 1923 the name was changed to the Bureau of Reclamation (Worster 1985: 170–1). The authorizing legislation, as amended, confined the Bureau's responsibility to seventeen Western states.

At the beginning of the twentieth century, Ohio Representative Theodore Burton, chairman of the House Rivers and Harbors Committee, challenged the so-called congressional 'pork barrel'. He believed that if non-federal interests—states and communities—partially funded projects, marginal projects would be weeded out. He also successfully promoted in 1902 the establishment of a Board of Engineers for Rivers and Harbours within the Corps of Engineers to review the cost-effectiveness and feasibility of rivers and harbours projects recommended by lower-level engineer officers. However, he opposed Progressive Era conservation proposals that, like some earlier ideas, would grant more power to the executive branch, usually through the creation of a board to plan and approve multipurpose projects that addressed a wide variety of needs, including navigation, flood control, irrigation, water supply, and hydropower. Multipurpose advocates thought the less water 'wasted', the better. Rational, scientific management would replace crude political calculations. Scientific efficiency rather than 'willingness to pay', would guide the planning and construction of water projects (Reuss 1991: 7).

President Theodore Roosevelt embraced multipurpose planning completely. He appointed an Inland Waterways Commission, composed of four government experts, two senators, and two representatives, to propose a comprehensive multipurpose plan for water development. Senator Francis G. Newlands of Nevada proposed yet another commission to carry out the plan. Newlands' proposal was Burton's worst fear. This new executive branch commission of experts would oversee the water programme and could withdraw funds from an Inland Waterway Fund without further congressional authorization. A majority in Congress, and just about every army engineer, shared Burton's concern, partly because of fear of executive branch growth and partly because the bill threatened Corps domination of federal water projects (Hays 1959: 105–10). Burton supported a substitute bill specifying that the commission would act only 'as authorized by Congress' (quoted ibid. 113). In 1908, the House overwhelmingly passed the bill, but the Senate killed it. The 1917 Rivers and Harbors Act actually authorized a waterways commission composed of seven presidential appointees. But President Woodrow Wilson never made any appointments, and Newlands' death in 1919 eliminated the act's major champion. In 1920, Congress repealed the waterways commission and instead established a Federal Power Commission.

Some army engineers objected to multipurpose projects because of constitutional reservations. More raised technical concerns over multipurpose reservoir operations. It was not clear, after all, how to operate a reservoir to respond to both hydropower, which requires a relatively full lake, and to flood control, which requires that the reservoir be as empty as possible to accommodate upstream floodwater. How would the engineers hold back water for later release to aid navigation as well as release the water to meet irrigation, water supply, and hydropower demands? The difficulties were many, and they remain so. None of this, however, impeded the Corps' performance when Congress gave it the responsibility in 1927 to prepare general multipurpose plans to improve navigation, waterpower, flood control, and irrigation for all the navigable rivers of the United States that seemed capable of supporting hydropower. The resulting '308 reports', named after the House document in which the cost estimates for the reports first appeared, provided basic data for multipurpose development for decades to come (Reuss 1992: 106).

The most successful co-ordinated efforts at water control responded to common economic requirements that transcended state borders. These requirements became pressing at the beginning of the twentieth century as a result of two unrelated developments: the need for irrigation water in the West and the growing demand for electrical energy throughout the country. The first development called for institutional, technological, and legal arrangements to allocate scarce water supplies throughout the West. The

second called for harnessing the nation's rivers to produce hydropower. The two developments coalesced in 1922, when the states in the Colorado River basin (except Arizona, which joined in 1929) signed the Colorado River Compact. Congress ratified the compact in December 1928 and also authorized the building of a great multipurpose dam in the Black Canyon of the Colorado: Boulder (Hoover) Dam. This initiated the era of regional compacts designed to make efficient use of the nation's rivers. Generally, these regional arrangements mirrored hardheaded political realities more than farsighted planning. When Boulder Dam was authorized, few anticipated a string of dams stretching from the Rocky Mountains nearly to the Mexican border.

Also in 1928, following a devastating flood the previous year, Congress authorized a massive flood control plan for the lower Mississippi River that substantially enlarged federal responsibility for the Mississippi beyond that provided in the 1917 Flood Control Act. The 1928 Act authorized the Army Corps of Engineers to build levees and revetments, dredge rivers, construct outlets, and formulate plans for flood protection for the entire lower Mississippi Valley. Except for the donation of rights-of-way for tributary levees and floodways, the project was to be built at full federal cost. This was both a technological and political experiment. Here there was no interstate compact to regulate water use, and no formal state approval was required. While the federal government's right to regulate interstate navigation had long been generally recognized, the 1928 Flood Control Act significantly expanded the national government's involvement in planning, implementing, and managing interstate flood control projects (Reuss 1998).

In the New Deal of Franklin Delano Roosevelt, river basin planning became a social experiment, and the Tennessee Valley Authority—developer of an area four-fifths the size of England—became the prototype. Questions abounded. Did the TVA administer a cultural, geographic, or natural resource region? What objectives should the TVA have and would they threaten traditional institutions and patterns of life? Were the engineering solutions economically efficient and socially beneficial throughout the basin, and did they address both short- and long-term needs? The TVA became a social laboratory, and, while it successfully provided electricity to the region, some of the social experiments initially envisioned were never implemented (Reuss 1992).

The Corps of Engineers began calculating benefits in the early twentieth century, but it was only in the 1936 Flood Control Act, which established flood control as a proper nationwide federal function, that Congress formally required benefit–cost ratios (Porter 1995: 148–89) The Act specified that benefits 'to whomsoever they accrue' should be ascertained, a requirement that enabled planners to consider an area much larger (or smaller) than the watershed to justify multipurpose development. The act also specified that

benefits must exceed costs before projects could be constructed. In the following decades, various interagency committees and the Bureau of the Budget developed criteria based on classical welfare economics to try to optimize net benefits. Instead of scientific efficiency, which had emphasized maximum water development, planners pursued economic efficiency. They looked at regional and national costs and benefits, including traditional objectives such as reducing flood damages as well as new concerns such as preserving ethnic enclaves, and, increasingly, reducing impacts on the environment.

The impact of the 1936 Flood Control Act on subsequent federal water resources development can hardly be overestimated. The legislation authorized 211 flood control projects—principally levees, reservoirs, and drainage channels—in thirty one states at an estimated cost of approximately $300m. (Hoyt and Langbein 1955: 175; Arnold 1988). Congress passed it in response to the suffering and devastation caused by the spring floods of 1936 and also to alleviate unemployment during the Great Depression. In the absence of floods and economic depression, it is doubtful the legislation would have reached the President's desk. Although the Act authorized only single-purpose flood control projects, most of the reservoirs authorized ultimately became multipurpose. The Act specified that non-federal interests contribute the lands, easements, and rights-of-way, hold the government free from damages due to the project, and operate and maintain the works. In 1938 Congress passed legislation that effectively eliminated these requirements for flood control dams and reservoirs and for channel improvement projects (49 Stat. 1570) but three years later restored them for channel and local protection projects (85 Stat. 638). The federal government continued to assume the full cost of constructing and maintaining navigation projects and flood control dams.

To those who still had reservations about the constitutionality of flood control, the United States Supreme Court supplied a definitive answer in 1940 in *United States* v. *Appalachian Electric Power Company*. In that decision, the Court ruled that flood control and watershed development come under the Commerce Clause of the Constitution. The following year, the Court pointed out in *Oklahoma* v. *Atkinson*, 'There is no constitutional reason why Congress cannot, under the commerce power, treat the watersheds as a key to flood control on navigable streams and their tributaries . . . there is no constitutional reason why Congress or the courts should be blind to the engineering prospects of protecting the nation's arteries of commerce through control of the watersheds' (quoted in Hoyt and Langbein 1955: 166–7). In a case before the Court in 1950 (*United States* v. *Gerlach Live Stock Co.*), the justices ruled that 'large scale projects for reclamation, irrigation, and other internal improvements' also fell under the constitutional provision to provide for the general welfare (quoted ibid. 167–8). Thus, consti-

tutional questions were effectively laid to rest on these issues after more than 150 years of ambiguity and acrimony.

The great dam-building era in American history followed passage of the 1936 Flood Control Act. Construction of Hoover Dam on the Colorado (the largest in the world upon completion), Bonneville and Grand Coulee dams on the Columbia, Fort Peck dam on the Missouri, the Bureau of Reclamation Central Valley Project in California, and several other dam projects had already commenced prior to passage of the Act. Fort Peck, Grand Coulee, and Bonneville had been started with emergency appropriations funds at the direction of President Roosevelt in response to the need for unemployment relief during the Depression. Among other projects, the 1936 Act authorized the Los Angeles Flood Control System, dams in New England, and a system of dams in the upper Ohio River valley. Subsequent amendments in the next ten years authorized a system of large dams along the Missouri River and more dams on the Columbia. Meanwhile, the Corps also constructed a system of locks and dams on the upper Mississippi River. The Bureau of Reclamation built Shasta Dam in California and numerous dams on the Colorado, culminating in Glen Canyon Dam, completed in the mid–1960s.

All these projects, numbering eventually into the hundreds, signified a major shift in the federal contribution to water projects, as can be seen from figures provided by the Hoover Commission on the Organization of the Executive Branch of the Government in 1955. Table 3.1 shows the federal investment in water resources broken down into chronological periods.

The Commission made no attempt to convert the numbers to current dollar values. Most of this federal investment, as we have seen, was in navigation and flood control projects. Irrigation and hydropower remained largely in the hands of private, local, or state entities. Federal investment in hydropower had increased from 1 per cent of the total in 1930 to over 13 per

TABLE 3.1. *Federal investment in water resouces, 1824–1954*

Period	Expenditure ($bn.)	%
1824–1920	1.15	8
1920–1930	0.86	6
1930–1945	2.58	18
1945–1954	9.73	68
TOTAL	14.32	100

Source: Reuss and Walker 1983: 1.

cent by 1953, making the federal government (mainly TVA, the Bureau of Reclamation, and the Corps of Engineers) the largest producer of hydropower in the country (ibid.).

In 1968, Congress established the National Water Commission to assess the country's water needs and to recommend improvements in both the planning and construction of projects. The Commission's 1973 report converted all figures to the 1972 dollar value and came up with estimated contributions (see Table 3.2) for water projects to the end 1969 (ibid. 3).

Comparing the Hoover and National Water Commission reports, we see an exponential percentage increase in federal contributions in the 27 years following World War II.

If we translate some of these funding figures into dam projects, we obtain an even more revealing perspective. The approximate number of dams built in the United States and still standing in 2001 is shown in Table 3.3 (several

TABLE 3.2. *National Water Commission estimate of conributions to water projects to end of 1969*

Contributor	Estimated amount ($bn.)
State and local interests (of which $180bn. for municipal water and sewage treatment)	194.5
Private interests	56.5
Federal	87.7
TOTAL	338.7

Source: Reuss and Walker 1983: 3.

TABLE 3.3. *Dams built in the United States and still extant in 2001*

Date of construction	No. still standing
Before 1900	2,532
1900–19	4,034
1920–39	5,968
1940–59	15,441
1960–69	19,310
1970–79	13,076
1980–89	5,017
1990–2001	2,557
TOTAL	67,935

thousand dams are not included because their dates of construction are not known).

Federal agencies and independent offices and commissions owned about 4,000 dams. The construction of federal flood control dams peaked in the 1960s, with the number of Corps of Engineers flood control facilities growing at an average annual rate of 6 per cent. The Corps completed 95 major flood control dams during the decade, while the Soil Conservation placed over 2,000 small watershed dams into service. Since that decade, the pace of construction has declined. Quite clearly, the golden age of dam construction, both federal and non-federal, occurred during the immediate post-World War II period (Federal Emergency Management Agency 2001: 36; Federal Interagency Floodplain Management Task Force 1992: 12. 9–13; Pearre 2001–2).

Post-World War II federal dam construction came despite numerous presidential efforts to reduce the federal largesse. President Eisenhower stressed local responsibility and tried to decrease strains on the federal budget by eliminating uneconomical or otherwise undesirable projects. He particularly wished to limit the federal role in waterpower development and to confine federal assistance under the small watershed programme of the Soil Conservation Service. President Carter proposed a 'hit list' of uneconomical or environmentally damaging projects, but in the end capitulated to Congress on many of them. President Reagan came into office with a programme that emphasized reducing the size of government and shifting some of the financial burden to states and communities and the private sector. Instead of attempting to cajole Congress into limiting water projects, as Carter had, Reagan far more successfully changed policy through budget manipulation. 'Budget is policy', was the lesson (Bartlett 1984: 121).

While recent presidents have periodically expressed dismay over wasteful water projects, it was congressional fragmentation rather than Executive Branch opposition that led to years of famine for water developers. More demands on the federal budget in the 1970s and 1980s meant that discretionary programmes such as water resources became candidates for fiscal restraint. Water projects amounted to only half of 1 per cent of the federal budget but to a little over 3 per cent of the discretionary budget subject to the budgetary axe (Reuss 1991: 65–6). In consequence, water interests fragmented, fighting among themselves for a decreasing share of the federal pie rather than mobilizing a strong, united front as they once had been able to do. Meanwhile, environmental organizations increased in strength and challenged some of the congressional pet projects. Changes in the congressional seniority system meant that some of the Corps' long-time supporters in the House and Senate no longer enjoyed the clout they once had. Nor in the environmental era was Congress apt to receive as much public support as

formerly for water projects. All of this meant that between 1970 and 1986, Congress passed no significant authorizing legislation for water resources.

Finally, in 1986 Congress passed and the President signed the Water Resources Development Act of 1986 (WRDA–86). It authorized 377 new projects for construction or study. More important, however, were the policy changes. The act put more of the financial and management burdens on the backs of non-federal interests, firmly integrated environmental considerations into water resources planning, and attempted to establish a process to reduce the number of marginal and uneconomical projects. It authorized about $16bn. in spending for water projects, of which the federal government would pay about $12bn. The Act required non-federal interests to pay 25–35 per cent towards the cost of flood control projects. Since 1978 inland waterway users had been assessed a user's fee, a tax on fuel sales for inland waterways traffic, to offset the costs of constructing and maintaining the vast inland lock and dam system. WRDA–86 confirmed the policy, instituting a programme of incremental increases in the fee over the next several years. Thus, WRDA–86 compelled beneficiaries to help fund water resource benefits, reversing the full federal funding that had supported navigation interests for 200 years and flood control dam beneficiaries for nearly fifty years. However, the philosophy behind these reforms was hardly revolutionary. Indeed, in putting more initiative, as well as the funding burden, in the hands of non-federal interests, the act was profoundly conservative, for it restored the federal–state relationship regarding water development that existed during much of the nineteenth century (Reuss 1991: 1–2).

Today, federal water resource agencies do far less structural development than they did a few decades ago. The 'big dam era' that lasted from the 1930s to about 1980 may well be seen as a blip on the screen in a few years. Practically, only so many dams can be built; the reservoirs behind US dams currently store about 60 per cent of the entire average annual river flow of the country (Gleick 1998: 70). Future projects probably will be more closely tied to watershed management and ecosystem restoration. Billions of dollars may be spent to undo what federal water agencies, pursuant to congressional direction, did earlier. The outstanding example is restoring the natural flow of the Kissimmee River, Lake Okeechobee, and the Everglades in south Florida. Congress has authorized a $7.8bn. appropriation for this project, and that will probably not be enough. Beginning in the early 1980s, more money has been spent on maintaining and operating facilities than on constructing new ones, although the Corps has calculated that 3,000 dams in the United States are unsafe and numerous locks on the Ohio, Upper Mississippi, and Columbia rivers are too old, dilapidated, and small to serve modern shipping (Reuss 1991: 38–9). Meanwhile, probably a minimum $100bn. is needed over the next twenty years to modernize water supply

and wastewater treatment facilities in the United States (Frederick 1991: 65). The US water resources infrastructure is obviously vital to the country's economy, so there is little question of letting it fall into disrepair. Yet, water planners must take into account both the economic benefits and the environmental costs, while politicians calculate how they can provide necessary services without increasing taxes or mortgaging a community's future through the bond market. There is no easy answer now, just as there was no easy answer 200 years ago.

Not only do we choose different projects, but we plan their design, construction, and, as we have seen, financing in ways that separate today's planning from that of a few decades ago. Indeed, the United States has entered a new era in planning, not formally recognized, but nevertheless manifestly evident. Replacing both the scientific efficiency model of the early twentieth century and the more recent economic efficiency model (which still formally remains) is an approach that compels planning by constraints. The process emphasizes regulation and focuses on water quality issues rather than on quantity. Instead of maximizing economic efficiency or optimizing the opportunity to meet public objectives, it sets limits to growth. Legal constraints include the National Environmental Policy Act (1969), which requires environmental impact statements for any federal project likely significantly to affect the environment, the Federal Water Pollution Control Act Amendments of 1972, and the Endangered Species Act (1973).

One possibly unforeseen impact of environmental legislation, especially of laws touching on water quality or on non-structural flood control projects, is the greater consideration given to concerns of ethnic minorities, the inarticulate, and the poor whose lives and property had often been sacrificed on the altar of national economic development. Issues of environmental justice that fifty years ago were easily ignored are now seriously addressed. Agencies increasingly favour alternative dispute resolution techniques such as arbitration and mediation to respond constructively when impasses threaten. These techniques keep disputes outside the courtroom rather than leave to the judicial system difficult decisions involving questions of equity and ethics.

Finally, we come back to answer the question posed at the beginning of this chapter: if liberty is to be constrained in exchange for access to adequate water of acceptable quality, Americans evidently prefer that it be done at the local, not the national, level Growing technical competence among non-federal entities buttresses this cultural preference. In the last few decades, states and communities have hired their own engineering experts and need not depend so heavily on federal water agencies. Often, federal money is accepted only if the constraints on local decision-making are acceptable. Even Western irrigation reflects this bias in favour of local initiative. The Bureau of Reclamation provides water to only 20 per cent of the irrigated land in the seventeen Western states (Storey 2002). Navigation improvements may be the only water-related area in which Americans still look to the national government for leadership, but today the water transportation industry helps offset the expense of construction and maintenance. In fact, all the elements that framed water resources planning in the early United States are still evident: distrust of government expansion, ambiguous boundaries between state and federal power, constitutional questions relating nowadays to wetlands regulations and the 'taking' of private property, a general deference to the private sector guided by Adam Smith's ubiquitous 'invisible hand', and political sectionalism that defeats rational national planning.

Water resources development will ever test the nature of American republicanism, as the boundaries between state and national power shift and as the border between liberty and authority responds to changing circumstances. Expensive water projects often require cost-sharing, respond to the needs of a large number of economic and social groups, and may affect large regions that embrace multiple jurisdictions and levels of government. Consequently, their planning and construction test the resilience of American institutions and challenge the nation to seek cooperative answers rather than capitulate to a much easier solution: authoritarian direction. It is not too much to say that America's answers to its water resources needs help to form the very contours of its democratic process.

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